Animal Communities

Project title: Epidemiology and Pathogenesis of Brucellosis in Bison of Yellowstone National Park

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Objective: Determine the natural course of brucellosis in free-ranging bison; determine modes of transmission; provide information on the prevalence of infection and abortion.

Findings: We removed radiocollars from our research animals fall of 2001. We located a large number of birthsites (42) during the spring of 2001, from both collared and noncollared animals. Bison apparently develop clinical brucellosis during their first pregnancy after exposure to the bacteria. Repeat reproductive failures, induced by brucellosis, appear to be uncommon. The primary route of transmission appears to be through contact with culture positive birthsites and birth products shortly after calving has occured.

Project title: Bison and Elk Responses to Winter Recreation in YNP

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Objective: This study addresses bison and elk responses to winter recreation in the upper Madison River drainage of Yellowstone National Park. Using data on weather; winter recreation activity; elk and bison distribution, behavior, abundance, and fecal stress hormone (glucocorticoid) levels collected during the winters of 1998–1999 and 1999–2000, we developed models to analyze if variables related to winter recreation contributed to bison and elk distribution, behavior, and stress hormone level responses.

Findings: The distribution models were inconclusive in terms of human activities displacing bison or elk from the road corridor (n = 1811 bison groups and 884 elk groups; R2 results for 4 models ranged from 0.10 to <0.01). Behavioral responses increased as distance between human activities and bison (n = 2189 group observations) and elk (n = 1097 group observations) decreased ($P < 0.001$ for both species). Both species behaviorally responded more often to people off-trail than to people on trails (bison n = 377 group observations, elk n = 220 group observations; $P < 0.001$ for both species), and human activities afoot prompted proportionately more behavioral responses than human activities on roads. Elk had higher stress hormone levels after exposure to >7,500 cumulative vehicles entering the West Yellowstone gate (n = 987; $P = 0.002$). Elk residing along the road segment with the greatest amount of oversnow vehicle (OSV) activity had higher stress hormone levels compared to elk residing along the less-traveled road segment ($P < 0.001$). As the daily number of vehicles entering the West Yellowstone gate increased, elk stress hormone levels increased ($P = 0.057$) while the probability of bison and elk behaviorally responding to human activities on the road decreased ($P = 0.001$ for both species). The predictability and frequency of OSV activities facilitated habituation to the majority of winter recreation activities. Abundance estimates indicated populations of wintering bison increased and wintering elk remained stable over 20 years. Despite varying responses to increased winter visitation since the late 1970s, bison and elk winter in the same area each year, coexisting with winter recreation without experiencing declining population numbers.

Project title: Predator–Prey Dynamics in a Wolf–Ungulate System

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Objective: The goals of the study are to quantify wolf predation rates, and prey selection, and to assess wolf predation impacts on the ungulate populations in the Madison, Firehole, and Gibbon drainages of Yellowstone National Park. Wolf spatial dynamic data are being collected on four scales in order to model how different factors (prey distribution, prey abundance, landscape features, snow pack and temporal trends) affect landscape use. Specific objectives include: 1) estimating winter ungulate abundance and composition, 2) estimating the amount of predation ungulates are subjected to over time (wolf days); 3) describing prey selection patterns; 4) describing temporal patterns in kill rates, both within and between winters, 5) estimating ungulate offtake by wolves according to species, sex, and age class, 6) describing recolonization patterns of the prey system based on wolf home range variation between winters, 7) determining wolf core use areas within the study area, 8) assessing factors that influence localized wolf movements, and 9) finding wolf kill sites and assessing which features influence their location.

Findings: Predation and spatial data is still being collected. Data has been systematically collected between November and May since 1998. Daily ground telemetry and snow tracking of wolves is performed to determine wolf distribution, abundance, and to locate kills. Necropsies are performed to ascertain the species, sex and age classes of kills. Locations of kills are recorded to examine kill distribution. The amount of data collected is determined by daily wolf activity. One hundred sixty definite and 31 probable wolf kills have been located during the study for a total of 187 kills. The species/sex/age breakdown of wolf kills has been 97 elk calves, 61 cow elk, 11 bull elk, 2 unknown adult elk, 15 bison calves, 1 cow bison and 1 unknown bison. An analytical method was developed to estimate smoothed kill rates across time using a moving window average and a weighting scheme to account for undetected kills. When applied to 1998–1999 and 1999–2000 winter data, this technique indicated that approximately 30% of the wolf kills were undetected. Estimated kill rates (kills/100 wolf days) calculated for 1998–1999 and 1999–2000 nearly doubled from fall to spring each winter, and were nearly twice as high the first year (11.8) as the second year (6.5). Differences between the 1998–1999 and 1999–2000 winters included snow pack, above average in 1998–1999 verses below average in 1999–2000, and wolf pack size, 7 and 13 animals. Estimated elk calf offtake was 20–25%, the highest among prey types. Wolves were triangulated from the ground 51, 88 and 145 times during each of the 1998–1999, 1999–2000 and 2000–2001 winters, respectively. The distribution of locations changed between winters, with the Gibbon drainage progressively becoming more included across the three winters. Wolf snow tracking was consistent across the winters of 1998–1999, 1999–2000, and 2000–2001, with 300 km, 302 km, and 341 km of tracks collected respectively. Distribution of tracks across the study area changed between winters, with an expansion of space used over the three years. The spatial distribution of kill sites has also been variable across the three winters.

Project title: Determining Bison Response to Mock Vaccination Approaches for Evaluating the Feasibility of a Remote Bison Vaccination Program in Yellowstone National Park: Phase I

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Objective: The primary purpose of Phase I is to determine the closest distance that park staff can safely approach bison on foot, horseback, snowmobile, and by vehicle during each of the four sampling seasons, while simultaneously minimizing stimulation of bison flight or aggressive responses. The bison management plan calls for YNP to be vaccinating bison with a remote delivery device before the third and final step of management actions outlined in the Record of Decision (ROD) will be initiated. Consequently, park managers must know 1) how effectively NPS staff can approach wild bison and not subject themselves to unnecessary safety hazards, 2) whether similar

methods of approach can be used throughout the park, and 3) whether biologists or technicians can approach wild bison to distances close enough to deliver a vaccine using current ballistic technology.

Findings: We observed a total of 6,303 bison over 208 individual approach sequences. In general, the initial reaction of bison to observers was minimal. The most prominent behavior when bison were first encountered was feeding and resting. There were no initial aggressive reactions. Initial attention/alarm reactions were only seen in two survey areas within the Madison/Firehole (4.35%). Bison in Yellowstone's northern range show more diverse activity at all stops than bison in the other survey areas including a greater percentage of anxiety responses such as ambling and running away.

Flight reactions occurred quite often in the northern range. From 42 total approaches in the northern range, flight reactions occurred 28 or 67% of the time. By comparison, in the Madison/Firehole area, out of 97 total approaches, flights occurred 29 or 30% of the time. In the Hayden Valley area and other areas, findings were similar to Madison/Firehole.

During the approaches, a sense of minimum or average minimum safe distances humans can approach bison was determined. There was, however, a great deal of variation. Generally, if a crew successfully approached to within 100 meters, they could also get to within 75 meters 100% of the time. Once at 75, 50 meters was attainable over half the time. There were times, however, when observers could not get to within 100 meters. We determined no pattern that can be used in future approaches to predict bison behavior a priori with any absolute certainty. Feasibility of a remote vaccination program is not simply how close humans can get to bison, but how safely, efficiently, and reasonably the remote vaccination process can be implemented.

The key point is that bison are not pushed into moving or behaving in a certain way but persuaded to do so. We believe this concept is the key to future successful approach and vaccination operations.

Pressure is defined by the following five determinants: 1) Distance (smaller the distance = the greater the pressure), 2) Location of Observers (Observers close together = more pressure), 3) Number of Observers (more observers = more pressure), 4) Predators in Area (Predators = Pressure), 5) Climate and Topography (Increase in environmental variables = more pressure).

Pressure release is as important as pressure applied. These two concepts in conjunction will influence bison behavior. An example of a pressure release is lateral movements. When maneuvering around bison, expert and timely application of lateral movements combined with direct movements influence bison group dynamics.

Parkwide it appears that bison can be approached to within 100 meters 92% of the time on foot and 87% of the time by horseback. The current remote delivery technology suggests that the B.T.I. compressed air rifle can deliver vaccines to distances as far out as 50 meters. If the technology improves enough to successfully deliver a vaccine that penetrates the skin of a bison calf or yearling at 50 meters, this study shows that vaccinating eligible individuals could be successful at least 68% of the time. By selecting an appropriate transportation mode relative to the location within the park and combining that with selective timing throughout the year, the frequency of successful approaches would be even greater.

The one caveat at this stage of investigation is that there appears to be a difference in approach distance expectations on the northern range of Yellowstone. A chi square test comparing observations of approach on the northern range and observations in the central portion of the park indicates a probability of less than 0.1% that approachability in these two areas are equal. Consequently, alternate strategies for

getting close to bison on the northern range may need to be developed.

Project title: Fecundity and Fawn Mortality of Northern Yellowstone Pronghorn

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Objective: Assess pregnancy status of all collared females. Capture fawns to record birth date, mass, and foot length, to attach a solar powered ear tag transmitter, and to obtain a two-gram tissue sample. Monitor fawns to record date of death and probable cause. In August, map locations of pronghorn groups, and count males, females, and fawns.

Findings: Twenty collared females were present in August 2000, and all were present at the start of the field season in May 2001. One female was killed by coyotes in early June and another was found dead in the Yellowstone River on November 10.

Of 20 females, we saw 18 in late stages of pregnancy. One female (795) was not pregnant for the third year in a row. Status of the other female (193) was uncertain. The minimum pregnancy rate is 18/20 = 90%. We obtained good estimates of the birthing dates of the 18 pregnant females that gave birth between May 21 and June 20. The median birth date was May 30. We weighed nine fawns born to six different females. Mean adjusted birth mass (Mass at capture ? [days age at capture x 0.2446]) was 2.95 kg.

Of the nine fawns captured, six were male and three were female. In the late summer count of 26 surviving fawns, 13 were male and 23 were female. One of nine (11%) of the ear-tagged fawns survived to August. Overall, six of the 36 (17%) fawns born to the 18 collared females were alive in early August. The median age of death of fawns was five days. In early August, we counted 93 adult females and with them 26 fawns. Ten of the 26 fawns were in the pronghorn group at Carbella, north of the park.

One adult female (163) was found dead and partly eaten by coyotes six days after the normal birth of her fawns. One adult female (884) was found in the Yellowstone River near Gardiner. This female was estimated to be 3–6 years of age when captured in 1989, so it is unlikely that her death was age related.